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THREE CASES OF CEREBRAL TUMOR, WITH AUTOPSY.¹

BY JAMES J. PUTNAM, M.D.



CASE I. Male patient, married, thirty-nine years of age: tumor of a sarcomatous character involving the posterior half of the right middle frontal convolution: symptoms, intense and incessant headache, almost exactly corresponding with the situation of the tumor; one well-marked attack characterized by partial loss of consciousness, and convulsive movements limited to the left shoulder; double optic neuritis, which was very much more intense on the side of the tumor; duration of the illness, six months.

The patient was a man of temperate habits, and presented no history or signs of constitutional disease. He had been for many years a policeman, and had had many injuries about the head, but could recall none to which his present disease could be especially referred. The features of special interest presented by the case are those that concern the localization of the lesion. In other respects the symptoms were gradually increasing pain, occasional slight epileptiform attacks without localizing value, and progressive mental dulness.

About six weeks before his death the patient was removed to the Massachusetts General Hospital by my advice, and was there placed under the care of Dr. J. C. Warren. Localizing symptoms were, at first, limited to the position of the pain, which always centred in the posterior part of the right temporal region, though it radiated to other parts of the head; and the far greater swelling of the optic papilla on the same side. This was confirmed on more than one occasion, by Dr. O. F. Wadsworth, as well as myself, but it was not considered as a reliable localizing sign. It is, in fact, generally believed, as is pointed out by Dr. Keen in the "Reference Handbook of the Medical Sciences," Vol.

¹ Read before the Boston Society for Medical Observation, May, 1889.

VIII, p. 218, that the tumor is usually on the side opposite to that of the greater neuritis. The difference between the two eyes, in this instance, was so marked that the case forms a striking exception to the rule.

In the hope of obtaining farther evidence of the presence or absence of a tumor in the temporal region, careful thermometric observations were made, with the result that, at the first examination, the temperature was found markedly higher on the suspected side, but that subsequently no difference could be detected. There was also tenderness on percussion in the painful area, but, as a rule, not exclusively there.

On passing, one day, through the corridor of the hospital, I had the good fortune to witness the attack which is next to be described.

The patient, when I first saw him, was sitting upon a bench, leaning toward the left side, not wholly unconscious, but with a stupid and vacant expression. When I spoke to him he seemed to recognize me, and said he felt sick. The left arm was abducted at the shoulder, the elbow being flexed, and slight but regular convulsive movements causing abduction of the arm, and, possibly, slight elevation of the point of shoulder, were going on. The left wrist and fingers twitched slightly, at the same time. Once only, I saw the right hand give a twitch. The body was so strongly inclined to the left that I could not straighten it without great effort. The head was very little, if at all, inclined to the left and was not rotated. The pupils were of medium size; pulse about as usual. The face had a congested look, but not more so than had frequently been the case of late. He was sufficiently himself to grasp my hand on request, and did so distinctly less strongly with the left than the right; the left knee-jerk was rather lively, and distinctly more so than the right; there was no ankleclonus. The convulsive movements gradually subsided in the course of a minute or two, but the patient remained in a stupid condition for some time longer, and as much as five minutes later the left knee-jerk was still greater than the right. An hour or so later, he was still in a confused state, not knowing where he was, but able to express himself intelligibly.

This was the only well-marked seizure which he had while in the hospital, so far as is known. From the testimony of his friends, however, and to judge from one slight seizure which I had seen at his house, six months before, it would appear, that, as a rule, both sides of the body had been involved, but, that the motions had been very slight, and vague in character, and not suggestive of localized irritation.

The subsequent history of the case presents no points of special interest, except that the left arm and leg became slightly weaker than the right. He soon returned home from the hospital, and, after some

weeks of headache and increasing mental dulness, he died. The post-mortem examination was made by myself, with the following result: The thoracic and abdominal organs all appeared to be in a normal condition, except that there was an anomaly in the position of the left kidney, which lay immediately above, and partly opposite the prominence of the sacrum, and nearly in the median line, its long diameter corresponding with that of the body, the hylus pointing backward and to the right. This kidney was, perhaps, one-sixth smaller than the right, which was somewhat larger than usual. The structure of both was normal, except for congestion. The rectum was displaced to the right side of the pelvis. The sigmoid flexure crossed the median line. The cœcum was in its usual position.

The cranium was of the usual thickness, and presented nothing abnormal. The dura-mater and pia-mater were normal in appearance. The convexity of the brain was absolutely dry, and the convolutions flattened so as to form a continuous surface. An accidental cut, made before removal, in the left frontal lobe, showed this also to be dry and pale. The right frontal lobe bulged forward more than the left, and at one point, situated at the middle of the second frontal convolution, at a spot lying between one and a half, and two and a half inches in advance of the pre-frontal sulcus, the bulging was especially prominent, and the finger received the impression of fluctuation. When the brain was removed, a little straw-colored fluid escaped at this point. The surface of the right hemisphere was found pushed across the median line and slightly adherent to that of the left. The pia-mater, over the bulging portion, was opaque, dingy and mottled. The base of the brain appeared normal, except that the optic tracts were excessively flattened by pressure. The ventricles contained a considerable quantity of fluid. The corpus callosum was soft and friable. A section through the right frontal lobe laid bare a grayish, almost translucent mass, mottled and streaked with red, with borders which were well defined anteriorly, less so posteriorly, and of slightly firmer consistency than the surrounding substance. This occupied the entire width of the middle frontal convolution, and extended from about the middle of the external convex surface of the frontal lobe, back to the pre-frontal sulcus. It also encroached somewhat on the superior and inferior frontal convolutions subcortically. The surrounding tissue looked healthy, except for the anæmia. The tumor measured two and a quarter, by one and three-quarter inches, the longest diameter following the length of the convolution. The rest of the brain appeared perfectly healthy, except for the usual effects of pressure. The right optic nerve was somewhat larger than the left and reddish in color.

It is possible that if the localizing indications furnished by the convulsion at the left shoulder, and the position of the pain had been followed, the tumor could have been successfully removed, though the operation would have been a severe one, and the limits of the growth on one side would have been difficult to define.

We did not forget that the experiments of Horsley and Beever² had indicated that movements at the shoulder are represented in the upper and anterior portion of the motor area, and recognized that the far greater degree of optic neuritis of the right side was, on the whole, confirmatory of the diagnosis of a unilateral tumor. Still, after considering that a characteristic convulsion had occurred, so far as we knew, but once, and then only as a pre-terminal symptom, and that the other signs were of only moderate localizing value, we did not think the operation justifiable. The propriety of this conclusion, from the conservative stand-point, seems borne out by the case next to be reported, where equally distinct localizing signs, occurring as pre-terminal symptoms, proved to be due to the effects of pressure from a distance.

The examination of the specimen, not only shows that the tumor was in a position to excite movements at the shoulder, but makes it highly probable that the strong inclination of the body to the left resulted from excitation of the nerves for the trunk muscles, which are represented on the mesial surface of the brain. The growth had, in fact, pressed against the para-central and para-frontal areas with sufficient force to displace the falx cerebri considerably to the right, rounding the edge of the hemisphere along the longitudinal fissure.

Why it is that the convulsions had not been more extensive and more frequent, is a problem such as has long called, and will long call for a solution. It may be the new growth exerts its irritating action mainly in the direction in which it is spreading and modifying the circulation; and it is also possible that it is the centres which are newly and acutely invaded, but still relatively healthy, that are most prone to react. It should be noted, with relation to the apparent failure of convulsion from excitation of the leg and foot centres, that the patient was sitting, during the convulsion at the shoulder, with the foot resting on the ground, and with his shoes on, so that slight movements of the foot and leg might have been overlooked.

The case is further interesting as negating the opinion³ that the second frontal convolution contains facial centres. The face, in the case, was not involved to any noticeable degree, either in the convul-

² Proceedings Royal Society, 1886.

³ Recently endorsed by Seguin (Annual of the Medical Sciences, 1888).

sion or paralysis. Of course, the evidence furnished by cases of tumor is not the best for settling questions of this sort. Still, in so far as a portion of the cortex was destroyed, symptoms might have been expected.

It is also noteworthy that there were no symptoms relative to the muscles of the head or eyes. The localized pain and the tenderness on percussion is explained by the fact that the tumor involved the pia-mater at the corresponding point.

CASE II. Two subcortical sarcomatous tumors, one occupying nearly the whole of the second temporal convolution, the other, the posterior part of the parietal lobe. The symptoms consisted in alteration of mental character; aphasia, partly sensory and partly motor, with alexia; a general convulsion, probably due to invasion of the membranes of the temporal lobe by the new growth; epileptiform seizures, consisting in tremor of the right arm and leg; right hemi-paresis of shifting intensity, terminating in complete paralysis with contracture; long continued coma; Cheyne-Stokes respiration; death, with rapid elevation of the temperature. The duration of the illness, so far as recognized symptoms are concerned, was five months. The case was seen by me in consultation with Dr. J. C. Warren, who kindly allows me to report it. (See next page.)

The patient was a gentleman fifty-eight years of age, always of slightly eccentric character and reserved manner, but of fair health and without any history of syphilis, or mischances likely to have led to the present illness, except that he sustained a great loss, two years before the first symptoms, in the death of his wife, after which, he became more than usually depressed and silent.

In other respects, he was as well as usual up to March 3, 1888. On that day, he went down town in the morning, but returned about noon. Immediately afterwards, the maid, who was up stairs, heard a scream, which in a moment was repeated, and going down, found him on the floor in the front entry, throwing his arms about, kicking his legs and rolling from side to side. His eyes were wide open and moving rapidly, but he could recognize no one. He tried to talk, and seemed to say "Me lone; me lone" [perhaps "let me alone"]. On being put on the bed, he continued thrashing about for an hour, and slept for two hours more. He vomited on waking and was thoroughly exhausted, but otherwise like himself, though he could recall nothing of what had passed. It was noticed, the next morning, however, that his right hand shook, so that he could scarcely hold a cup. After this he was unusually and unnaturally gay and happy for a time, and would whistle and sing, but he soon began to have difficulty in speech, miscalling names and losing his

power of conversation, so that on going to make a call, he would find himself unable to say anything, and would quickly come away. He would say "he" for "she," and "niece" for "daughter," and would also forget to do his ordinary business at the bank, etc. He would set out to write a sentence and then find that he had written something different from what he intended. On discovering the mistake, he would say, "This is not what I wanted to write; it is the greatest trash in the world; I must be going crazy."

At about this period he began to have severe headaches, about once a week, and would often come down in the morning looking ghastly pale and weak, while at other times, he would seem like himself. He used to complain that his right hand left weak and shaky, and May 14th was the last time that he used it for writing. At times a sort of tremor would run through the whole right side, like a momentary chill, even while he was lying in bed. He would also complain of "not hearing," which is evidently to be interpreted as "not understanding," since his hearing was excellent, and sometimes the names of friends, even very familiar names could not be made to convey any meaning to him. Nevertheless, it is to be noted that this difficulty in understanding, was relative only, since, even at a later period than this, he evidently did understand simple questions and answered them, though somewhat incoherently.

He misdirected letters, writing, for example; "Massachusetts Avenue, Washington, Newport." He could not spell correctly, and once on trying to write a check, he wrote the figures "100" correctly, but on trying to write the word at length, he failed. He generally realized when he was wrong, but was not able to set himself right, and would be greatly distressed. He could, however, for a time, copy correctly, and used the dictionary to check his spelling. Reading soon became difficult or impossible, and during May, he carried a letter from an intimate friend around with him in his pocket for a long time, occasionally making a pretence of reading it, but never really doing so.

The patient was first seen by me on May 20th. The physical examination showed nothing of importance, except the fact, that there was no trace of optic neuritis, as Dr. O. F. Wadsworth had also noted a short time before. There was no certain evidence of facial paresis, or weakness of the right arm or leg as compared with the left, to be found by direct examination, but soon after this he began to have difficulty in shaving, and he had already given up writing altogether.

During June he remained most of the time in bed, coming down stairs a few times only, and then at the cost of great effort. In spite

of his great feebleness, however, he had one or two attacks of excitement in which he forced his way up and out of the room, but in one of these attempts he fell on the ground from weakness. From this time on he remained constantly in bed, growing steadily weaker, and taking less and less food.

At about this period he had several attacks of sudden faintness, characterized by great pallor and prostration, and feeble respiration, lasting about an hour and a half and ending in a comatose sleep. Also, both then and later, he had slight convulsive movements of the right hand and arm, and, to some extent, of the leg, sometimes of the character of a sort of tremor, sometimes of twitching of the flexor muscles. The face was not involved in these movements, and was subsequently less paralyzed than the arm and leg.

So far as his responses could be trusted, there was no marked loss of sensibility of the affected limbs, which is of some importance on account of the position of the lesion, subsequently found, which involved the parietal lobe, and only indirectly the motor area. It may at least be said that he resented pricking and pinching of the right side as much as of the left.

About a month before his death, well-marked double optic neuritis was found but the examination was made under so great difficulties that it could not be said whether it was greater on one side than the other or not.

Paresis of the right side (arm, leg, and face), came on, then passed away, then returned and deepened into paralysis. For a number of weeks before his death, he lay scarcely living, taking practically no food, and making no response to any excitations. During this period he secreted much more urine than would be accounted for by the fluid which he drank. He died on August 18th. During the three last days of his life the internal temperature ran up rapidly, so that, whereas on August 15th at noon, it was only 97.5° F. (axilla), it reached 98.8° F. by night, and on the 18th, at night, it was 103° F. For a month, and perhaps more, previous to this, the morning temperature had been sub-normal, as a rule. The lowest point reached was 97.4° F., the highest, 99° F. The daily range varied from .2° to 1.2°, and the curve was very irregular. The pulse, during the last month, ranged from 60 to 90, generally rising about ten beats toward night. During the last three days before death it increased, with the respiration, from 93 (morning of August 15th) to 150 (morning of August 18th). The respiration was for a long time excessively feeble and shallow, and occasionally of Cheyne-Stokes character.

The post-mortem examination was made by Dr. Samuel Delano and myself.

Nothing abnormal was found in the abdominal or thoracic cavities.

The condition of the head was as follows: External and internal surfaces of the dura, normal; pia of convexity, of usual appearance; convolutions of left side greatly flattened, those of right side to less degree. As the brain was removed, the pia covering the middle portion of the second convolution of the temporal lobe was found adherent to the dura, over a spot about the size of a quarter of a dollar, just above the tentorium cerebelli, and close to the apex of the petrous portion of the temporal bone. The cortex tore through at this point, showing a softened, disintegrated, yellowish tissue beneath. On further examination, it appeared that the entire second left temporal convolution was filled with this softened tissue, to within about three centimetres of its anterior end, and that, at the point where the adhesion and the rupture had occurred, the cortex and the underlying substance were of relatively homogeneous consistency, much harder to the touch than the surrounding tissues and of a translucent grayish appearance. On subsequent examination, it proved that the posterior portion of the left parietal lobe also contained a sub-cortical mass of the new growth of the size of a horse-chestnut, and was extensively softened, mainly from excessive oedema. The convolutions of the Rolandic region on the side of the disease were apparently normal. The whole brain was very soft and pale, but the right hemisphere seemed otherwise normal. On examination from below, the left optic tract was found flattened and broadened to twice the size of the right, and yellowish in color. The left optic nerve was, however, slightly smaller than the right and grayish in tint. The left crus projected somewhat, and its strands were pushed a little apart by swelling and oedema. No macroscopic signs of secondary degeneration were seen on cross-section. The vessels of the base were pervious. The sixth and third nerves of both sides were reddish-gray in color.

The brain was placed in Müller's fluid, but this, unfortunately, was not sufficiently often renewed, and the specimen eventually spoiled.

Microscopic examination of the tumor showed it to be composed almost wholly of small cells.

The most important features in this case are those that relate to the aphasic symptoms, and the discussion on these points may profitably be deferred until the next case has been reported.

The absence of marked sensory symptoms has been alluded to. No importance should, however, be attached to this point as proving any-

thing in regard to the sensory functions of the parietal lobe, because that part of the new growth was not very large and was situated at the posterior border of the lobe, besides being probably of slow growth.

CASE III. Short attacks of arrest of power of speech for short periods, without complete loss of consciousness or of power of expression in writing, or of comprehension of simple speech or written signs, but preceded by trifling tremor of right hand; permanent, slight hesitancy in speech, with slight paraphasia; occasional general convulsions, without aura; frontal and occipital headache; mental failure; finally, repeated attacks of slight convulsive action of flexors of right hand, with tendency to contracture; paresis of extensors; operation by Dr. H. H. A. Beach; tumor not found at the point thought to be indicated by the symptoms (just above the motor speech area) but found after death in the supramarginal gyrus, at its posterior end.

This patient, was seen by me in consultation with his physician, Dr. David Choate of Salem, to whom I am indebted for permission to publish the case. He was a man fifty-one years of age, married, and of temperate habits in all respects. He had always had good health and had sustained no injuries, with the important exception that, twenty-two years ago, he was knocked from a freight car while passing under a bridge. He was general agent of a large railroad at the time of his illness, and worked hard without much rest, and often late at night.

The first symptom of his present disease (September, 1888), was a trembling of the right hand, which was noticed by the assistant in his office. Immediately after this, while he was sitting at his desk and talking with his assistant, he found himself, of a sudden, unable to speak, though his mind felt perfectly clear. He did not, at this time, attempt to write, but from subsequent experience in similar attacks, felt certain he could have written as rapidly and as correctly as ever. He was not paralyzed, and kept at work from two o'clock, when his first seizure occurred, until five. During the whole of this period he had some difficulty in speech, although the complete inability had passed away in the course of a few moments. He had also some difficulty in adding long columns of figures.

A little while after the first difficulty in speech, he was seen to rise without apparent cause, turn toward the window, and then again seat himself, and as he placed his right hand on his desk it seemed to be affected with a slight spasmodic, rotating sort of movement.

On leaving his office at five o'clock, he went directly to Dr. Choate's, and while telling him what had occurred, found himself again unable to speak, and had to express himself by signs. Both Dr. Choate and the

patient himself assert there was no loss of consciousness, nor of comprehension of, at least, simple speech. Dr. Choate said to him, among other things, "You know what you wish to say, do you?" to which the patient gave an emphatic assent. After a few moments he began to utter a few simple words, as "yes," and would repeat them over and over, as "yes. yes. yes." He would also begin a sentence and then break off, unable to finish. There was no convulsion or paralysis, or convulsion of the face or limbs. Gradually, the speech returned to a great extent, and he went home.

The same tendency to recurrent utterance of simple words or sentences was seen on other occasions.

At bed-time he had a general convulsion with complete loss of consciousness, but without special aura or localizing symptom. During the next two weeks he had frequent returns of difficulty of speech, but sometimes several days would pass without any such attacks.

A second convulsion occurred a few days before I saw him, which was January 1, 1889. He was making his preparations for coming to Boston, and was a little hurried. The attack came on as he sat down to take some lunch. It was general in character, like the first. His wife noticed, first, a staring look in the eyes, a moment later the eyes deviated to one side, and he lost consciousness. During the week previous to this, the attacks of speechlessness were said to have been more frequent than before.

The physical examination on his first visit to me was entirely negative, except that a slight hesitancy of speech was noticed. There was no tremor of hands or tongue; the pupils were small, but equal and quickly responsive. There were no sensory symptoms at all. The optic disks were perfectly clear.

A few weeks later it was found that his memory and capacity for work were progressively failing. Headache began to come on and steadily increased in severity, though at first distinctly intermittent. His gait had become unsteady, suggesting that of a drunken man, and when I saw him again, on January 24th, I found the knee-jerks exaggerated. The pupils were then slightly unequal, the left, that on the side of the new growth—being slightly larger than the right. Both reacted well to light and with accommodation. No difficulty was noticed in his comprehension of speech, and the difficulty, on his part, of expressing himself, seemed to be wholly from limitation of his vocabulary, except that words were sometimes misplaced or dropped.

Dr. Choate wrote to me, that, even early in January, at the time of his first visit to me, "there began to be marked difficulty in making-

out his pay-roll. He would be one or two days behindhand in completing it" and by the last of January, at the time of his second visit to me, "he was utterly balked in the attempt [to make out the pay-roll] and threw down the book with an expression indicative of complete disgust." The patient's assistant reports that on January 25th (while still struggling with his office duties), he "could not write his name, nor a message for the telegraph operator." Also, he "would begin a remark, and suddenly stopping, would say, 'I have forgotten what I was going to say.'"

The aphasic symptoms in the intervals between the attacks of entire speechlessness, consisted, at first, in a sort of hesitancy and a tendency to remain silent or to use short sentences. Later, "he would certainly mispronounce and sometimes try to correct himself. Again, he would use quite a wrong word."

Soon after this his increasing headache and weakness obliged him to keep his bed, and his general mental dulness obscured the more special symptoms. The pain in the head was, as a rule, frontal, though sometimes occipital, whereas in the beginning it had been mainly occipital.

On February 18th, Dr. Choate writes that the patient had vomited twice during the last few days, and yawned frequently and he would speak but seldom and then used but few words and often failed to complete his sentences.

I saw him again on February 21st, and found marked optic neuritis. The patient was then dull, and slightly wandering in mind, and had difficulty in recognizing his sister-in-law, who had just come from Boston. No facial paralysis or relative weakness of either hand or leg could be made out. The patient's mental condition did not admit of tests of sensibility of any value, but not the least indication of either paræsthesia, hyperæsthesia, or anæsthesia had been complained of or noticed by others at any time. An attempt to sit up in bed caused, after a moment, a severe paroxysm of headache, attended with marked flushing of the face. The pain was not localized. The knee-jerk was increased on both sides. His wife said that in attempting to take a cup to drink, he had spilled the contents. This may, however, have been due to inattention, for he raised both hands to his head and moved all the fingers with apparent ease.

I could not make out that hemianopsia was present, but the examination was of little value on account of his mental condition. The pulse at this period was as low as 45, 47, and 48. at different times. The first symptom that could be called localizing, besides the aphasia, occurred on February 26th, and was described to Dr. Choate by the pa-

tient's wife as follows: The right arm was lying on the bed, extended with the palm uppermost, when a decided convulsive action of the flexors of the hand and fingers was noticed, which continued at intervals for about two hours. Part of the time the contraction was persistent, the hand being flexed on the wrist and the fingers on the hand, and was so strong that his wife was unable to overcome it. There was also a convulsive action of the upper eyelids and the eyeballs were raised.

The symptoms recurred occasionally during the following two days, but to a less degree. The patient was delirious at times, and made attempts to get out of bed.

In view of the convulsive movement of the right arm, above alluded to, it was decided to send the patient to the Massachusetts General Hospital with the view of a possible operation, as a last resort, large doses of iodide of potassium having failed to cause improvement, and he accordingly entered on March 1st, and was placed under the care of Dr. H. H. A. Beach.

Before leaving his home, which was in Salem, the patient had quite an alarming turn of faintness, and fearing recurrence of this symptom, I asked Dr. Beach to operate at once if he thought it justifiable, and this he kindly consented to do.

During the night before the operation, a number of slight convulsive attacks occurred, affecting the right hand and arm at the elbow, as well as at the wrist. The patient was dull all the time, but no special increase in the dulness was noticed during the attacks.

On the morning of the operation I noticed for the first time, a paresis of the extensors of the fingers of the right hand. There was no complete paralysis, and during occasional movements of the arm toward the face, the loss of power was not observable, but when the fingers were passively raised they would immediately drop again in quite a different manner from those of the left hand.

It may be added that the movements of the right hand, though sometimes tremulous, were not such as to suggest any impairment of muscular sensibility or coördination. No change of sensibility seemed to be present, but the patient's mental state precluded a thorough examination of this point. Optic neuritis, which had been noticed for the first time on February 15th, was present, and about equal in the two eyes.

In view of the fact that the patient's first symptom had been a marked loss of speech, preceding such general signs as headache; that there had been a recurrent spasm of the hand and fingers; and that no symptoms had occurred which I was able to interpret confidently, as

pointing to any lesion of the parts posterior to the central convolutions, such as the loss of muscular or cutaneous sensibility, sensory aphasia, or special disorders of vision, I concluded that the tumor, which was so evidently present, was in the anterior lobe, opposite the lower part of the central convolutions, and probably just above the third frontal convolution. I excluded a lesion of the central convolutions and of the motor pyramid tract by the fact that marked paralysis was absent in spite of the severity of the pressure as indicated by the other symptoms.

Drs. G. L. Walton and P. C. Knapp were kind enough to see the patient with me before the operation, and, on the whole, concurred with this opinion, and in the view that operation was justifiable as a matter of last resort.

The operation was performed by Dr. Beach, in accordance with this diagnosis, but no tumor was found.

The patient never recovered from the comatose state in which he was left by the operation, and died on the second morning following. At the autopsy, which was made on the same day, by Drs. W. F. Whitney and R. H. Fitz, the tumor was discovered at the same level where it had been sought, but considerably behind the motor area.

The exact boundaries were as follows: The posterior edge of the growth was limited by the posterior ascending branch of the fissure of Sylvius. The anterior boundary was formed by a small sulcus, leaving the fissure of Sylvius a little behind the anterior extremity of the interparietal fissure, which ran down parallel to the fissure of Rolando and was continued by a sulcus opening into the Sylvian fissure.

A frontal cross-section of the brain made between the tumor and the central convolutions showed the tissues there to be healthy, although highly œdematous. The motor convolutions themselves, and the frontal convolutions were perfectly healthy, except as regards the effects of pressure and disturbed circulation. The optic tracts were strongly compressed.

The tumor, on cross-section, was found to run inwards, as a somewhat pyramidal body, with its borders not sharply defined, undermining three-fourths of the inferior parietal lobule, but leaving a clear space of œdematous and yellowish, but, otherwise, healthy tissue between itself and the nucleus lenticularis, the posterior edge of which was just visible on the section through the middle of the mass. Apparently, the growth was not quite far enough back to involve the intra-cerebral optic fibres.

The pia-mater over the tumor was adherent, and discolored. A space of about three-quarters of an inch intervened between the posterior edge of the Rolandic convolutions and the nearest point of the tumor.

The cortical area of the brain which is concerned in the language function, is very large, extending from the base of the lower frontal convolution back to the occipital lobe and the first and second temporal convolutions. A subcortical lesion almost anywhere in this triangle may damage the associating tracts or ganglionic centres which subserve this delicate function.

The symptom which generally engrosses most attention in cases of aphasia, is the loss or disorder of speech and writing, but the important question from the standpoint of localization is whether this loss of expression is due to a paralysis of the motor or "executive" arrangements (Ross), or is indirectly caused by a loss of the power of understanding language symbols. In other words, an impairment of speech, perhaps even a complete loss, does not necessarily indicate a lesion of Broca's area, but may be due to the fact that a lesion of the auditory centres, which stand in such close and necessary relations with the speech centres that the two form almost a physiological unit, embarrasses the delicate speech function, or, temporarily, inhibits it altogether.

This may have occurred in Case III, where a tumor at the posterior extremity of the Sylvian fissure, far removed from Broca's area, caused as its first symptom, repeated attacks of complete loss of speech, with well-marked hesitancy in the intervals. One of these attacks was followed after a time by a general convulsion, and accompanied by signs of transitory mental change, and tremor of the right hand, but others were attended neither by convulsion, paralysis, nor loss of consciousness. Furthermore, the patient positively asserted that he was able to read and write intelligently during some of the attacks, and his physician was confident that he understood accurately what was said to him. As regards the first point, Dr. Choate had noted, under the date of December 14th, that "under a little excitement in his office he was unable to say to his assistant what he wished, but at once sat down and wrote, apparently without difficulty, what he had wished to say, but could not."

As regards the physiological explanation of the case, we may assume either that the speechlessness was due to an irritation or "discharge" of the auditory area, causing temporary inhibition of the speech functions, sufficient to prevent expression, yet not enough to wholly destroy the comprehension of simple matters; or to circulatory interference with the conducting tracts; or to increase in the general cerebral pressure, leading to anæmia and œdema, and to loss of the speech function on account of its relative sensitiveness. Of these suppositions the third seems the most probable, but whether it be correct or not, the case is

instructive as showing the danger in assuming a lesion of the lower frontal convolution, even where loss of vocabulary seems the prominent symptom, and loss of the comprehension of speech relatively slight. The position of the tumor makes it probable that the later loss of the use of written symbols was due to disturbance of the visual area or its connections, but it certainly was not sufficiently pronounced to positively justify this diagnosis. A frontal position of the tumor seemed further indicated by the localized tremor-like convulsion of the fingers and wrist-muscles, with eventual loss of power in the extensors of the fingers; but it now seems evident that these symptoms indicated only a relatively great mobility or instability on the part of the corresponding flexor centres, and a greater vulnerability on the part of the extensor centres—facts which are quite in accordance with well-known principles.

With regard to the evidences of disturbance of the specific functions of the parietal lobe, in which the tumor lay, the only signs of loss of muscular sense were that early in January, while the patient was still in pretty good condition, his assistant noticed that his hand would occasionally slip off from the table or desk without his knowledge; that he had some difficulty in forming his letters and holding his pen, and that the gait became unsteady; but these symptoms might be attributed, perhaps, to general cerebral pressure.

The movements of the upper eyelids during the convulsive attacks of the last few days of life gains in interest from the fact that such movements have been located by Landouzy and Grasset (quoted by Gowers) in the inferior parietal lobule.

One point is worthy of notice as regards the patient's inability to express himself in long sentences (which he would fail to complete, saying that he had forgotten what he had meant to say), namely, that this may be due to the condition first commented upon by Grashey, in which aphasia results from a loss of retentive power of the ganglionic matter probably from impairment of its nutrition.

The aphasic symptoms in Case II are of interest, partly as supporting the usual opinion as to localization of the cerebral functions, partly as showing the caution with which it is to be applied.

In spite of the fact that the new growth, with the subsequent softening, had almost destroyed the second left temporal convolution, the loss of the power of comprehension of speech was not complete, though, at one time, perhaps, out of proportion to the limitation of the vocabulary. After a time, the general mental failure made the accurate study of the less marked symptoms impossible, and the disorder of the circula-

tion disturbed the action of all the cerebral centres. The most marked early symptom referable to the language functions was the alexia.

The patient's mental condition, and unwillingness to submit to closer examination, made it very difficult to study this symptom, but its presence may fairly be attributed mainly to the presence of the tumor in the parietal lobe.

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